IB Biology B1.2 Proteins

Worksheet 04 — Core SL review of protein basics

Worksheet	Core SL review of protein basics
Recommended time	50–60 minutes
Indicative marks	34
Coverage	Amino acid structure, peptide bond formation, diet, denaturation, sequence and function.
Teacher note	SL questions are included throughout. HL-labelled items can be used for extension, differentiation, or separate HL assessment.

This mixed review worksheet targets the main SL ideas in B1.2 and adds selected HL challenge items on why primary structure influences higher-order protein form.

Section A — Multiple choice

Choose the best answer for each question. 1 mark each.

1. [SL] Which feature is variable among the 20 naturally occurring amino acids used in proteins?
A. The presence of an alpha carbon
B. The amine group
C. The carboxyl group
D. The R-group

2. [SL] Which statement about peptide bonds is correct?
A. They join monosaccharides
B. They form during condensation between amino acids
C. They are present only in quaternary proteins
D. They are broken to make water

3. [SL] Which protein-related statement is correct?
A. Protein identity depends only on length
B. The order of amino acids determines protein identity
C. All proteins are fibrous
D. All proteins are enzymes

4. [SL] A protein loses function in strongly acidic conditions mainly because
A. its glucose monomers separate
B. its normal shape is disrupted
C. it becomes a lipid
D. it gains more peptide bonds

5. [HL] Why do two proteins with different primary structures often fold differently?
A. Different sequences alter opportunities for later intramolecular interactions
B. Primary structure has no effect on folding
C. Only environmental temperature matters
D. All proteins fold into the same shape

Section B — Short answer

6. [SL] Draw or describe the generalized structure of an amino acid. (4 marks)

7. [SL] State the products of a condensation reaction between two amino acids. (2 marks)

8. [SL] Explain why a vegan diet requires attention to protein sources. (3 marks)

9. [HL] Explain how a change in primary structure could alter an enzyme's active site. (4 marks)

Section C — Data response / case study

A class compared two samples of the same enzyme after incubation for 15 minutes under different conditions.

Sample	Condition during incubation	Relative activity after return to optimum conditions
X	8 °C above optimum	92 %
Y	50 °C above optimum	4 %

10a. [SL] Which sample shows mainly reversible denaturation? (1 marks)

10b. [SL] Use the data to explain why sample Y is likely to have suffered more severe structural damage. (3 marks)

10c. [HL] Explain why the amino acid sequence of both samples is likely to remain the same even though their activities differ greatly. (3 marks)

Section D — Extended response

11. [SL/HL] Using examples from this topic, explain how proteins can be both highly specific and environmentally sensitive. (8 marks)

Answer key and marking guidance

Use the guidance flexibly. Equivalent scientific wording should receive credit where it is biologically accurate and consistent with the source material.

Section A — Multiple choice answers

Q1	D	Q2	B	Q3	B	Q4	B
Q5	A						

Section B — Short answer guidance

6. [SL] Award up to 4 marks for a correct generalized description/diagram including alpha carbon bonded to amine group, carboxyl group, hydrogen and R-group.

7. [SL] 2 marks for dipeptide and water.

8. [SL] Up to 3 marks: some plant foods are limited in certain essential amino acids; humans must obtain essential amino acids from the diet; combining varied sources helps provide the full set.

9. [HL] Up to 4 marks for linking amino acid sequence to folding, folding to three-dimensional conformation, conformation to active-site shape/chemistry, and altered active-site fit to reduced activity.

Section C — Data response guidance

10a. [SL] 1 mark for sample X.

10b. [SL] Up to 3 marks: Y has almost no activity after return to optimum conditions; this suggests extensive denaturation; stronger or underlying structural damage likely prevented normal renaturation.

10c. [HL] Up to 3 marks for stating that denaturation usually affects shape rather than sequence; peptide-bonded primary structure may remain intact; different activity reflects altered conformation rather than a new sequence.

Section D — Extended response guidance

11. [SL/HL] Award up to 8 marks for discussing sequence-specific synthesis, precise shape, specificity of enzyme active sites/hormone receptors/structural roles, importance of the amino acid order, and sensitivity of weak interactions to non-optimal pH and temperature causing denaturation and altered function.